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A ‘Crikey’ new snake: An insular *Lycodon* Fitzinger, 1826 (Squamata, Colubridae) from the Nicobar Archipelago, India

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Abstract

The Nicobar Archipelago, a biodiversity hotspot in the Bay of Bengal, harbours several poorly studied and endemic reptile lineages. Several species of snakes from these islands are known to science with just one or a handful of specimens. One such taxon, historically identified as *Lycodon subcinctus* Boie, 1827, has remained taxonomically unresolved, known only from a single sighting on Great Nicobar Island to date. Recent taxonomic revisions of the *L. subcinctus* complex enabled us to reassess the status of the population from the Nicobar Islands. Studies suggested that the species is distinct, and a re-examination of museum material and newly collected specimens, combined with molecular analyses, confirms the distinctiveness of the species and is here described as a new species, *Lycodon irwini* **sp. nov.** Given its rarity and restriction to Great Nicobar Island, and taking into account potential threats we recommend that the new species be classified as ‘Endangered’ under the IUCN Red List criteria.

Key Words

Colubridae, conservation, island, phylogeny, Sundaland, systematics, taxonomy, wolf snakes

Introduction

Members of the genus *Lycodon* Fitzinger, 1826, are small to medium-sized nocturnal snakes that are an integral part of the Oriental ophidian fauna. Over the past two decades, the genus *Lycodon* has received substantial taxonomic attention. This has led to revisions of several widespread species and description and revalidation of several old names, which, incidentally, makes *Lycodon* the second-most speciose snake genus in Asia, with 74 recognised species (Ganesh et al. 2020; Wang et al. 2020; Nguyen et al. 2022; Nguyen and Vogel 2025; Uetz et al. 2025). The taxa of focus in this study belong to the *Lycodon subcinctus* Boie, 1827 group, which has undergone several taxonomic revisions in recent years. This group was historically regarded as a single, widespread, and morphologically variable species distributed across much of mainland Southeast Asia and the Greater and Lesser Sunda Islands of Indonesia. (Wogan et al. 2008; Nguyen et al. 2009; Wallach et al. 2014; Liu et al. 2023)

The first detailed assessment of this group by Leviton (1955) documented morphological variation correlated with geography and recognised three subspecies: *Lycodon subcinctus subcinctus*, occurring across most of the species’ range (including Indochina, Thailand, Malaysia, and Indonesia); *Lycodon subcinctus sealei* Leviton, 1955, from Palawan Island (Philippines) and Borneo (East Malaysia and Kalimantan, Indonesia); and *Lycodon subcinctus maculatus* (Cope, 1895), attributed to populations in China. In the following years, the populations from Palawan and Borneo were elevated to full species status as *L. sealei* (see Leviton et al. 2018; Weinell et al. 2019). Liu et al. (2023) presented

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evidence for the distinctiveness of the population from southern China and attributed the name *L. "maculatus"* to this population. This prompted Nguyen et al. (2024) to assess the nomenclature issues of *L. "maculatus"*, which revealed that the name was not available to the population from southern China but to the Mexican species *Leptodeira maculata* (Hallowell, 1861). Therefore, Nguyen et al. (2024) proposed a new name, *Lycodon neomaculatus* Nguyen, Lee, Pauwels, Kennedy-Gold, Poyarkov, David & Vogel, 2024, for this population, which was more widely distributed than previously demonstrated. Most recently, Nguyen et al. (2025) designated a neotype NHMUK 1860.3.19.1307 (holotype of *Lycodon platurinus* Cantor, 1847) for *Lycodon subcinctus* from Penang, in peninsular Malaysia.

Following these taxonomic updates, the current distribution of the *Lycodon subcinctus* group is as follows: *Lycodon subcinctus sensu stricto* occurs across southern Thailand, Peninsular Malaysia, Singapore, Indonesia (Sumatra, Java, Bali, Nusa Tenggar, Alor, Flores, Sumba, Sumbawa); *L. sealei* across Palawan Island in the Philippines and the entire island of Borneo and *Lycodon neomaculatus* occupies the mainland regions of China. At a glance, the taxonomy of this group appears largely resolved, with the exception of an insular population from the Nicobar Islands, India. The species was first reported by Harikrishnan et al. (2010) from the Nicobar Islands based on a single specimen recorded from Great Nicobar Island. Harikrishnan et al. (2010) provided a photograph and morphological details of this specimen, which was subsequently deposited at the Zoological Survey of India, Port Blair (Catalogue No. ZSI/ANRC/T 10643). The recent revision of the taxon by Nguyen et al. 2024 & Liu et al. (2023), raised doubts about the conspecificity of this population with *Lycodon subcinctus* sensu stricto, based on morphological data presented by Harikrishnan et al. (2010). These revisers speculated that the population likely represents a distinct species and referred it as *Lycodon* cf. *subcinctus* (see Liu et al. 2023; Nguyen et al. 2024). The molecular phylogeny presented by Siler et al. (2013) and thereafter by Harikrishnan et al. (2010), Nguyen et al. (2024) and Liu et al. (2023), which included all other species of the group, lacked molecular data for this Nicobar population. This absence of additional specimens and molecular data left the taxonomic identity of this insular population unresolved.

To determine the identity of the Nicobar population of the *Lycodon*, we re-examined the specimen collected by Harikrishnan et al. (2010) (ZSI, Port Blair, Catalogue No. 10643), traced an additional specimen from the same population (ZSI, Uncatalogued), and collected a fresh specimen from Great Nicobar Island. Our investigations, combining morphological and molecular comparisons with other members of the group, confirm the earlier hypothesis that this population represents a distinct lineage, which we describe and name herein.

Materials and methods

Morphology

A total of three specimens of the *Lycodon* sp. from the Great Nicobar Island were examined. Measurements were taken with digital calipers to the nearest 0.1 mm and total length was measured using a non-elastic thread with an error of 5 mm. Ventral scales were counted following Dowling (1951). The number of dorsal scale rows was counted at approximately one head length behind the head (at 10th ventral), at midbody, and at about one head length before the vent (10th ventral before the cloacal plate), respectively. Subcaudal counts reported here do not include the terminal scale. The measurements and terminologies follow Nguyen et al. (2024) and Kalki et al. (2020) with some modification. The specimen designated as the holotype is housed in the collection of the Department of Ocean Studies and Marine Biology (DOSMB), Pondicherry University, Port Blair, a recognized repository of zoological collections. The Paratype and an uncatalogued referred material from this study are housed at the Zoological Survey of India Andaman and Nicobar Regional Centre, Port Blair. Comparative morphological data was sourced from Nguyen et al. (2024) and Liu et al. (2023).

Molecular methods

Genomic DNA was isolated from the preserved tissues of the female holotype using Qiagen DNAeasy kits following protocols provided by the manufacturer. A fragment of the mitochondrial cytochrome b (*cyt b*) gene and nuclear oocyte maturation factor mos (*c-mos*) were amplified. Published primers L14919 & H16064 (Burbrink et al. 2000) and S77 & S78 (Lawson et al. 2005) were used for amplification and sequencing. A 22-µl reaction was set containing 10 µl of Thermo Scientific Dream Taq PCR Master Mix, 9 µl water, 0.5 µl of each primer, and 2 µl template DNA, carried out with an Eppendorf Mastercycler Nexus GSX1. Thermo-cycle s used for amplification were as follows: 94 °C for 5 min (denaturation temperature 94 °C for 30 s, annealing temperature 48 °C for 50 s, elongation temperature 72 °C for 1 min) × 30 cycles, 72 °C for 10 min, hold at 4 °C. PCR product was cleaned using a QIAquick PCR Purification Kit and sequenced with an AB 3730 DNA Analyzer. Taxa selected for the phylogenetic analysis is as selected by Nguyen et al. (2024) and Liu et al. (2023). Downloaded sequences (Suppl. material 1) were aligned in Mega X (Kumar et al. 2018) using ClustalW (Thompson et al. 1994) with default settings. For optimal partitioning strategy and evolutionary substitution model, aligned data were analysed using ModelFinder (Kalyaanamoorthy et al. 2017), listed in Suppl. material 2. The dataset was partitioned as per codon position for c-mos, cyt b and RAG-1 genes.

Maximum Likelihood (ML) analysis was carried out using IQ-Tree (Minh et al. 2020) through an ultra-fast search method with 100000 bootstrap replicates. Un-corrected pairwise p-distance (% sequence divergence) was calculated in MegaX (Kumar et al. 2018) with pairwise deletions of missing data and gaps.

Results

Molecular analysis: The phylogenetic analysis (Fig. 1), based on concatenated data for mitochondrial *cyt b* and nuclear *c-mos*, recovered similar relationships as in recent studies, specifically those of Nguyen et al. (2024) and Liu et al. (2023). The snake from the Great Nicobar Island was recovered as a member of the *L. subcinctus* group (Fig. 1). The *L. subcinctus* group is represented by the basal *L. neomaculatus*, which is sister to a clade (ML bootstrap 100) containing *L. sealei* as the basal lineage (ML bootstrap 81) to *L. subcinctus* and the representative from Great Nicobar Island. The Nicobar *Lycodon* is sister to *Lycodon subcinctus s. s.* with high clade support (ML bootstrap 99). The Nicobar *Lycodon* shows an uncorrected pairwise sequence divergence of 6% from *L. subcinctus s. s.* and 6–17% from other members of the *L. subcinctus* group.

Taxonomy

A review of the putative synonyms of snakes from the Nicobar Islands and that of *Lycodon subcinctus s. s.* shows that the population from Great Nicobar Island does not bear any name and represents a new species. Based on support from molecular data, morphology and allopatric distribution (see below), we describe the population from the Great Nicobar Island as a new species.

Systematics

***Lycodon irwini* sp. nov.**

https://zoobank.org/23516E73-33ED-4006-BA36-1D787669A1F1

Figs 2–4, Table 1

Lycodon subcinctus – Harikrishnan et al. (2010).

Lycodon cf. *subcinctus* – Liu et al. 2023; Nguyen et al. 2024.

Holotype. DOSMB 05114 (adult female), collected near Gandhi Nagar, Great Nicobar Island (6.810923°N, 93.878795°E; 140 m asl) on 15th August 2017 by S.R. Chandramouli.

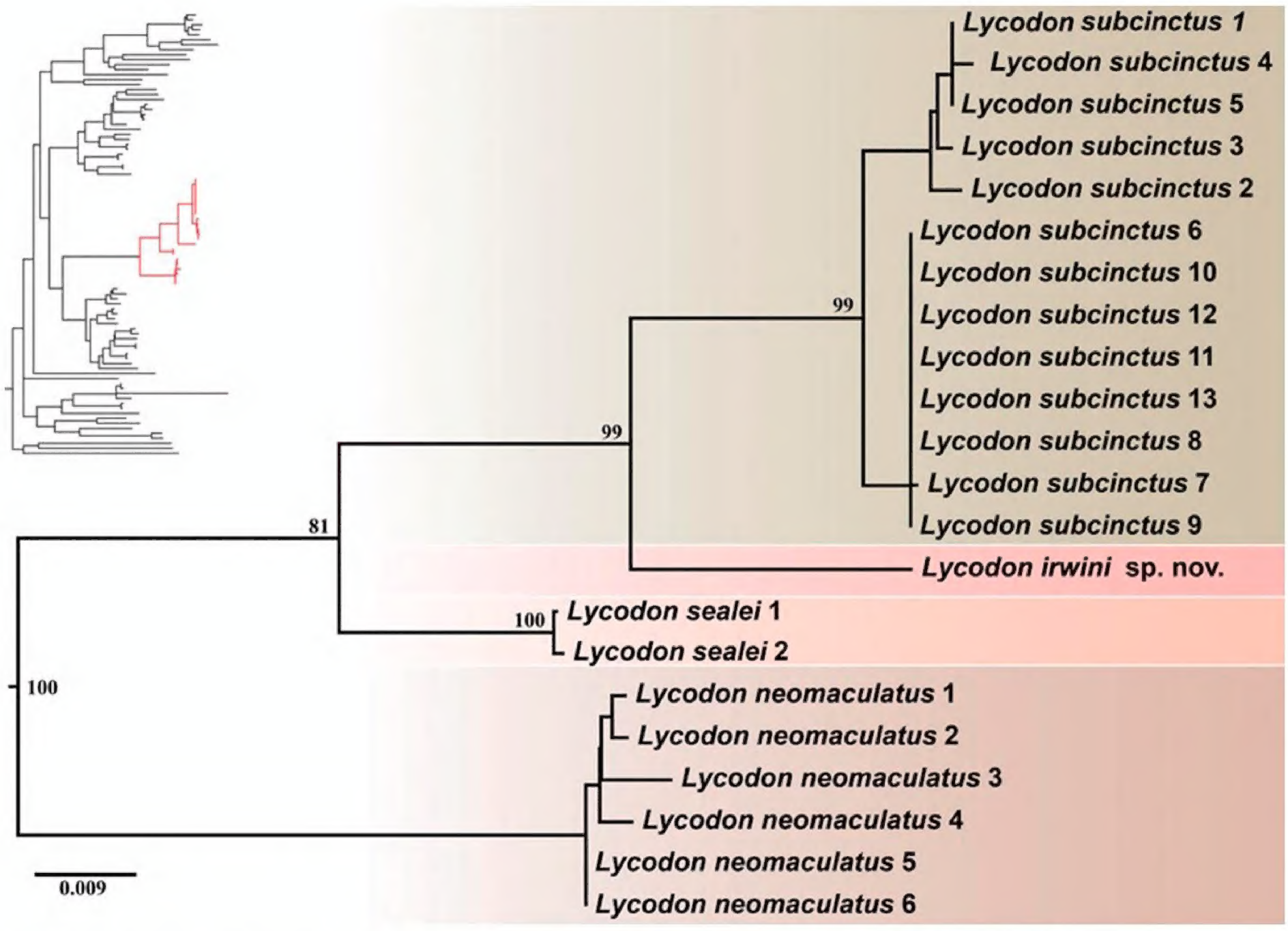

Figure 1. Maximum Likelihood (ML) phylogenetic tree based on concatenated mitochondrial (cyt b) and nuclear (c-mos) gene sequences, showing the placement of the *Lycodon* sp. from Great Nicobar Island within the *Lycodon subcinctus* group.

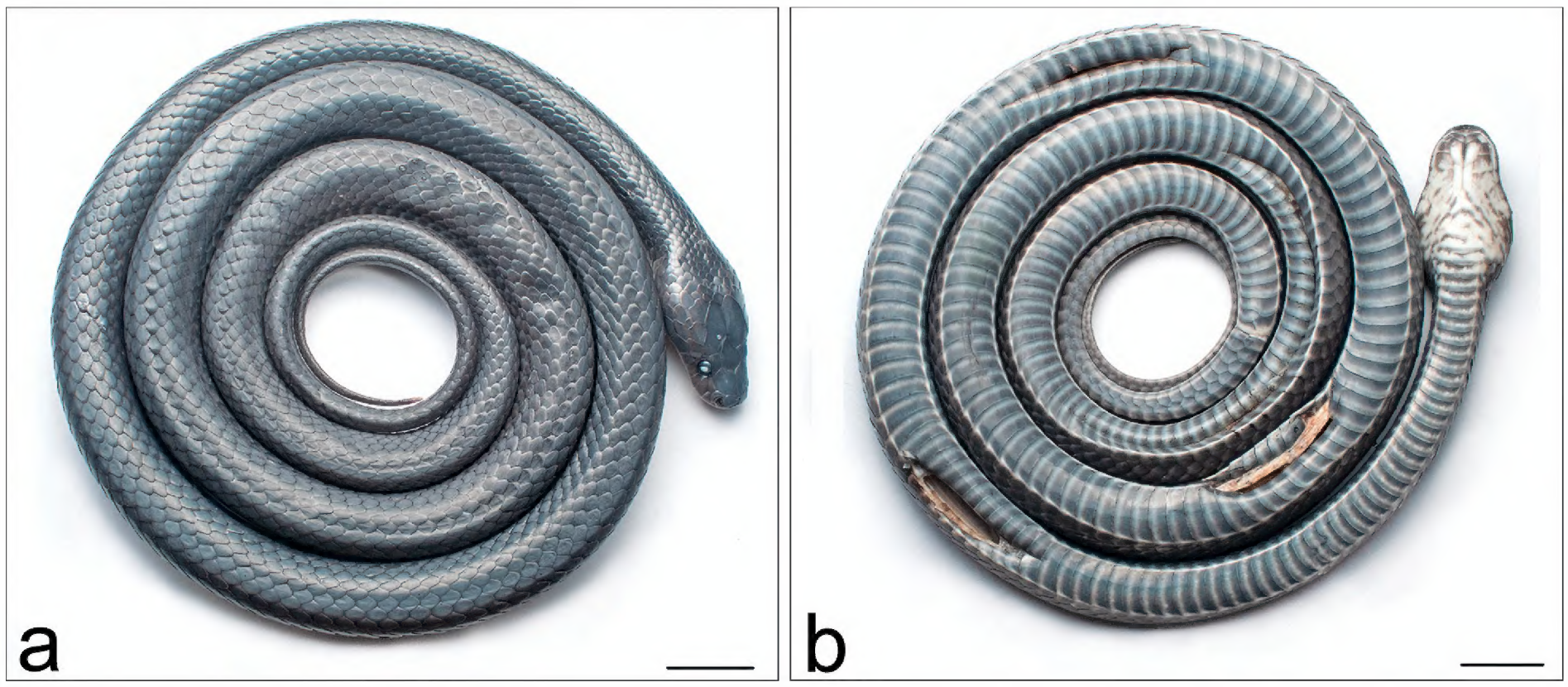

Figure 2. *Lycodon iriwini* sp. nov., adult female holotype (Voucher no. DOSMB 05114). **a.** Dorsal view; **b**. Ventral view. Scale bars: 10 mm.

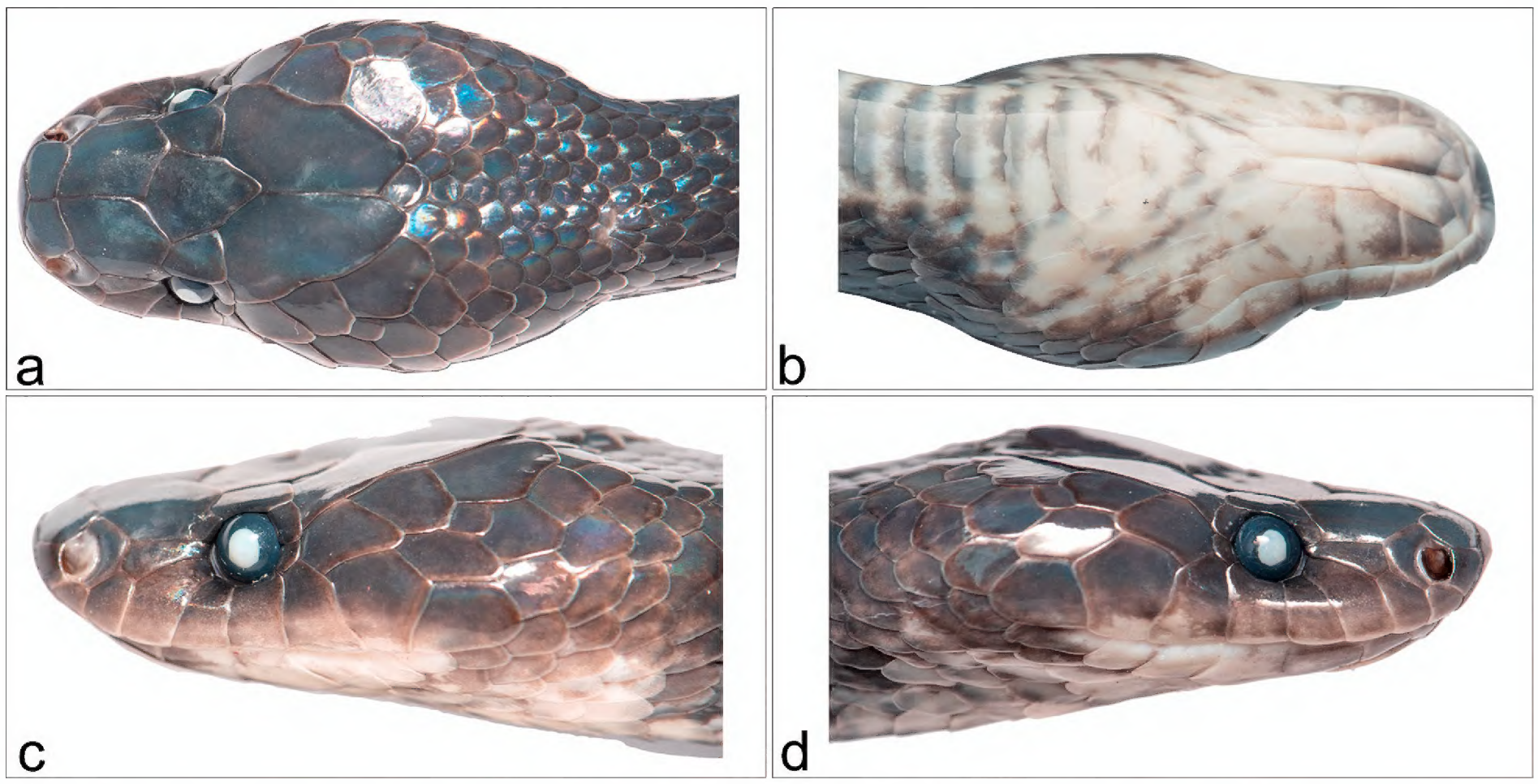

Figure 3. *Lycodon iriwini* sp. nov., adult female holotype (Voucher no. DOSMB 05114), head views. **a.** Dorsal aspect; **b.** Ventral aspect; **c.** Right lateral aspect; **d.** Left lateral aspect.

Paratypes. One adult female, ZSI/ANRC/T/10643 collected from Govind Nagar, at the 10 km point, along the East-West Road, Great Nicobar and

Other referred material. One adult female ZSI/ANRC uncatalogued specimen from Galathea Bay, Great Nicobar.

Diagnosis. A *Lycodon* characterized by the following characters: body size fairly large, maximum known total length up to 1197 mm, slender; preocular maybe present or absent (present here only in the holotype), loreal touching orbit; dorsal scale rows 17-17-15, anterior part of the body with smooth scales and posterior parts with the outermost rows smooth and the remaining rows feebly keeled; ventral scales 223–238; subcaudals 78–94, paired; TaL/TL 0.20–0.23; supralabials 8, with the 3rd–5th touching orbit; postoculars 2/2; cloacal plate divided. Dorsum overall in a shade of glossy black, lacking bands and ventrally greyish black with cream ventrolateral ridge.

Comparison. *Lycodon irwini* sp nov. can be distinguished from all other members of the *L. subcinctus* group by the occasional presence of a preocular scale (vs. always absent in *L. subcinctus*, *L. sealei* and *L. neomaculatus*); pre-frontal not in contact with orbit (vs. in contact in *L. subcinctus*, *L. sealei* and *L. neomaculatus*); absence of white bands across the dorsal surface (vs. present in *L. neomaculatus*). A higher number of ventrals, total 223–238 (vs. 187–208 in *L. neomaculatus*, 198–211 in *L. sealei*); higher number of subcaudals, 78–94 (vs. 59–69 in *L. sealei*), TaL/TL 0.20–0.23 (vs. 0.16–0.18 in *L. sealei*), sum of ventral and subcaudals 304–330 (vs. 261–274 in *L. sealei*).

Figure 4. *Lycodon irwini* sp. nov., dorsolateral view of an adult female in life.

Description of the holotype (Fig. 2, 3 and 4). Specimen DOSMB 05114 is in a good state of preservation. The specimen was fixed in a flat coil with its head resting outside the coil and the tail in the centre. The ventral aspect of the specimen bears three longitudinal incisions made to retrieve tissue for molecular analysis and to attain optimum penetration of the fixative and preservative.

Body slender; tail long, gradually tapering to a pointy and enlarged whitish terminal scute; head oblong shaped, longer than wide (Headw/HeadL 0.88), slightly flattened, moderately distinct from the neck; snout elongate, projecting over the lower jaw, rounded in dorsal profile, truncate and slightly depressed in lateral profile with a weak canthus rostralis; nostrils large, positioned dorso-laterally, round in shape; eyes medium with an elliptical and slightly vertical pupil.

Body scalation. Dorsal scale rows 17-17-15; anteriorly dorsal scale rows smooth, scale rows feebly keeled at mid-body and posteriorly (dorsal scale keels beginning from 68th ventral scale), except for the outermost row, which is smooth throughout; scales of the vertebral row not enlarged; 226 ventral scales, laterally angulate; 78 subcaudals, paired and laterally angulate; cloacal plate divided.

Head scalation. Rostral sub triangular, wider (6.92 mm) than deep (3.19 mm), barely visible from above; nasal longer (5.36 mm) than high (3.19 mm), partially divided by a small suture above nostril; posterior half of nasal subpentagonal, larger than anterior nasal; nasal surrounded by the first two supralabials, rostral, internasal, prefrontal and loreal; internasals paired, in contact with rostral, nasal, and prefrontal, slightly wider (3.98 mm) than long (3.3 mm); prefrontals paired, longer than internasals, subrectangular, longer (6.7 mm) than wide (5.62 mm), in contact with internasal, nasal, loreal, eye, and frontal; supraoculars paired, subrectangular shaped,

Table 1. Morphological data of *Lycodon irwini* sp. nov. Remarks: – = data not available; M = adult male; F = adult female.

Species	*Lycodon irwini* sp. nov.	*Lycodon irwini* sp. nov.	*Lycodon irwini* sp. nov.
Voucher No:	DOSMB 05114	ZSI 10643	ZSI Uncatalogued
Status	Holotype	Paratype	Referred material
Sex	F	F	F
Location	Gandhi Nagar, GN	Govind Nagar, GN	Galathia, GN
SVL (mm)	963	660	550
TAL	234	180	160
TL	1197	840	710
TAL/TL	0.2	0.21	0.22
Head length	25.34	–	–
Head width	22.33	–	–
Head depth	12.92	–	–
Eye dia	3.09	–	–
Eye- nostril	5.02	–	–
Eye - snout	10.26	–	–
scalerows	17:17:15	17:17:15	17:17:15
ventrals	226	223	238
subcaudals divided	78	94	92
Anal	2	2	2
SnL	10.14	–	–
SnW	7.27	–	–
IoD	11.14	–	–
FrontalL	7.8	–	–
FrontalW	4.64	–	–

longer than wide, in contact with prefrontal; frontal small, hexagonal, slightly longer than wide (ratio FrontalL/Frontalw 1.05), tapering posteriorly; parietals paired, 12.1 mm long, 6.24 mm at its widest anterior. and longer than frontal; loreal subrectangular, longer (4.97 mm) than high (2.02 mm), in contact with eye; postoculars 2/2, uppermost scale larger than lowermost; temporals 1AT+2PT; 3+3 nuchal scales, slightly larger than adjacent dorsal scales, bordering parietals. Supraocular longer (4.23 mm) than wide (3.12 mm), larger than preocular; preocular deeper (1.72 mm) than wide (1.24 mm); supralabials 8/8, first and second in contact with nasal, second and third in contact with loreal, third and fifth in contact with eye, third supralabial largest; infralabials 9/9, first pair in contact, first to fifth in contact with the anterior pair of chin shields; mental subtriangular in ventral profile, wider than long; anterior chin shields longer than posterior shields; posterior chin shields in narrow contact medially, separated by skin tissue along the mental groove.

Coloration in preservative. Uniformly bluish-black dorsally from head to tail tip. Laterally, it transitions from black to brownish-black; the head ventrally is creamy with dark grey, poorly defined blotches. The ventral cream colouration bleaches onto a few of the supralabial scales, which are partly in a shade of the dorsum head colouration and partly of the ventral. The preventrals are mainly in a shade of cream, with light grey on their posterior borders. The grey colouration deepens in intensity and area on each subsequent ventral scale, and each scale is nearly dark grey to black, with a thin, faint light grey or cream transverse band roughly at mid-length of each ventral scale. The sharp ventrolateral edge is creamish, merging into a longitudinal stripe on either side of the venter.

Variation. Both paratypes agree well in general morphology and coloration. Morphometric and meristic variation is documented in Table 1.

Etymology. The specific epithet is a patronym honouring the late Stephen Robert Irwin (22 February 1962–1964 September 2006), the renowned Australian zookeeper, conservationist, television personality, and wildlife educator. His passion and dedication to wildlife education and conservation have inspired naturalists and conservationists worldwide, including the authors of this paper.

Natural history, distribution, and conservation status. The holotype was collected in a moist evergreen forest, where the snake was observed on a road. Another specimen (ZSI, uncatalogued was also collected from a moist evergreen forest (pers. comm. G. Gokulakrishnan)). Another uncollected adult female was observed by RSN crossing the East-West Road near Govind Nagar, in a similar moist evergreen forest habitat. Currently, only four records of this species are known, three of which are based on collected specimens described in this study. All known specimens are from Great Nicobar Island, and despite targeted surveys on other Nicobar Islands, the species has not been recorded elsewhere, suggesting it is likely endemic to Great Nicobar Island. Its rarity in field encounters implies it may be naturally scarce, highly cryptic, and possibly confined to the island's evergreen forests. Considering this, along with potential threats from ongoing development activities that could impact its only known habitat, we recommend assessing the species as Endangered on the IUCN Red List under criteria B1ab(iii); C2a(ii).

Discussion

Phylogenetic relationships within the genus *Lycodon* are comprehensively resolved, and the results of the present study closely align with recent investigations conducted by Nguyen et al. (2024) and Liu et al. (2023). The congruence of the phylogenetic relationships identified attests to the robustness of the findings and their subsequent inference, particularly concerning the lineage originating from the Great Nicobar Island. The new species is a member of the *L. subcinctus* group and not of the *L. aulicus* group, to which the other two species of the genus (*L. hypsirhinoides* and *L. tiwarii*) reported from the Andaman and Nicobar Islands is speculated to belong. The affinity of *L. hypsirhinoides* and *L. tiwarii* to the *L. aulicus* group is based on their seemingly similar morphology rather than molecular data.

The distinctiveness of *Lycodon irwini* sp. nov. was anticipated by researchers in the recent past based on morphology, as well as the fact that the population is isolated on this island (Liu et al. 2023; Nguyen et al. 2024). The present work confirms this hypothesis through molecular data from both mitochondrial and nuclear genes. The new species is 6–17% divergent from other members of the *L. subcinctus* group at the Cytochrome b gene, which is enough to treat it as a separate species, as similar threshold values have been used to distinguish species in the genus *Lycodon* and related colubrid genera (Guo et al. 2015; Nguyen and Vogel 2025). We reject the idea that the Nicobar species is merely an isolated, genetically divergent population of *L. subcinctus*, since it also exhibits morphological traits used to delineate species in addition to substantial genetic divergence.

Harikrishnan et al. (2010) reported the presence of 21 snake species in the Nicobar Islands, with *Gongylosoma nicobariense* (Stoliczka) and *Sibynophis bistrigatus* (Günther) known from single specimens. In addition to that, a specimen in Zoological Survey of India, Kolkata, of a *Pareas* sp. and unconfirmed records of *Cantoria* sp. from the Nicobar Islands necessitate evaluation based on further specimens to verify their presence in these islands.

Extensive fieldwork combined with detailed genetic and morphological analyses reveals that the diversity and endemism of vertebrate species in tropical regions, particularly on islands, are significantly underestimated (Vasconcelos et al. 2016; Reilly et al. 2021; Oliver et al. 2024). The Nicobar Islands, part of the Sundaland biodiversity hotspot, are renowned for their high rates of endemism. Located south of the Andaman Islands across the Ten Degree Channel and north of the Sundaic island of Sumatra, these islands cover only 1,841 km² across 22 islands. Despite their small size, they host a variety of

habitats, including mangrove marshlands, grasslands, and dense evergreen forests. The herpetofauna here is exceptionally diverse, with many species being endemic (Das 1998; Vijaykumar and David 2006; Chandramouli 2020; Chandramouli et al. 2023). Although herpetological research and specimen collection have been ongoing since the mid-1700s, starting with Blyth (1846), the Nicobar Islands continue to reveal unique, previously unknown lineages (Mirza et al. 2025). The archipelago has a long history of misidentified records, many of which are still under investigation. New species continue to be discovered, exemplified by *Lycodon irwini* sp. nov., highlighting the ongoing progress in taxonomy and the incomplete understanding of herpetofaunal diversity and distribution in the region. Additionally, although the Nicobar Islands are biogeographically linked to Sundaland, their isolated biota may represent distinct lineages, emphasising the need for focused taxonomy and conservation efforts.

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Supplementary material 1

GenBank accession numbers

Authors: R. S. Naveen, Zeeshan A. Mirza, Girish Choure, S. R. Chandramouli

Data type: xlsx

Explanation note: GenBank accession numbers of the DNA sequences used

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Link: https://doi.org/10.3897/evolsyst.9.170645.suppl1

Supplementary material 2

Substitution models

Authors: R. S. Naveen, Zeeshan A. Mirza, Girish Choure, S. R. Chandramouli

Data type: docx

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Supplementary material 3

p - distance

Authors: R. S. Naveen, Zeeshan A. Mirza, Girish Choure, S. R. Chandramouli

Data type: xlsx

Explanation note: p - distance between the DNA sequences studied.

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